Single-electron transport by surface acoustic waves

Vyacheslavs Kashcheyevs

School of Physics and Astronomy,
Raymond and Beverly Sackler Faculty of Exact Sciences
Tel Aviv University, Tel Aviv 69978, ISRAEL

We use the theory of single electron adiabatic quantum pumping to calculate the current driven through a depleted quantum point contact by a surface acoustic wave (SAW). For sufficient SAW power, an (almost) integer number of electrons is transferred per SAW period, thus giving quantized values to the current [1, 2]. This quantization is a result of quantum interference and does not require a Coulomb-blockade effect. We reproduce qualitatively various experimentally observed properties of the quantized acoustoelectric current [3], which include the dependance on SAW amplitude and wavelength, accuracy enhancement by a counter-propagating SAW and the effects of an additional source-drain bias. Conditions for optimal single-electron transport are discussed.

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